SUMMARY OF RESEARCH

NASA-Ames University Consortium
grant NCC2-5008 to Rice University

for research on

"Silicon and Carbon Abundances in the Orion Nebula and Planetary Nebulae"

– a final report submitted 1996 September 30th

by

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1. Introduction

This report summarizes the research activities of Drs. R. J. Dufour and D. K. Walter of Rice University during the period 1994 October 1 through 1995 September 30 related to the program "Silicon and Carbon Abundances in the Orion Nebula and Planetary Nebulae." This research was conducted in collaboration with Drs. A. G. C. M. Tielens and R. H. Rubin at the NASA Ames Research Center. The research primarily involved the analysis of *Hubble Space Telescope* spectroscopy of the Orion Nebula, and secondarily involved the analysis of archival *International Ultraviolet Explorer* spectra of planetary nebulae. However, other research involved with ground-based imagery and spectroscopy of the Orion Nebula was conducted during this period that was peripherally supported by the grant NCC2-5008 to Rice University.

2. Summary of Accomplishments – Publications

Attached to this report are several publications that in themselves describe the results of this research. The primary paper resulting from our collaboration is the paper " Physical Conditions in Low-Ionization Regions of the Orion Nebula," which has appeared in the 1996 September 10 *Astrophysical Journal Letters* (copy attached). A second paper, "[FeIV] in the Orion Nebula," has recently (1996 August) been submitted for publication in *Astrophysical Journal Letters* (preprint attached).

Prior to these two papers, our early preliminary results were published as short papers at symposia. Three of particular note are:

Rubin, R.H., Walter, D.K., Dufour, R.J., O'Dell, C.R., Baldwin, J.A., Ferland, G.J., Hester, J.J., & Martin, P.G. 1995, in *The Analysis of Emission Lines*, Proc. STScI Symp. (May 1994), Eds. R.E. Williams & M. Livio (Cambridge U. Press), p. 66 – "HST FOS Spectroscopy of the Orion Nebula".

Walter, D.W., et al. 1995, in *The Analysis of Emission Lines*, Proc. STScI Symp. (May 1994), Eds. R.E. Williams & M. Livio (Cambridge U. Press), p. 81 – "A GHRS Spectrum of the Orion Nebula".

Rubin, R.H., et al. 1996 in *Unsolved Problems of the Milky Way*, IAU Symposium 169, Eds. L. Blitz & P.J. Teuben (Dordrecht: Kluwer), p. 629 – "HST Spectroscopy of the Orion Nebula".

Copies of these three summaries of meeting posters are attached.

Finally, as part of "satellite research" projects related to the Orion Nebula and UV spectroscopy of HII regions and planetary nebulae in general, but not necessarily in close collaboration with Tielens and Rubin at Ames, we note the publication of three papers for which support via NCC2-5008 was acknowledged (via support for the partial postdoctoral salary of D. K. Walter and summer salary for R. J. Dufour):

"A Rapidly Moving Shell in the Orion Nebula," by D. K. Walter, C. R. O'Dell, X. Hu, and R. J. Dufour, in *Publications of the Astronomical Society of the Pacific*, **107**, 686-690 (1995).

"Anonmalous Balmer continuum Temperatures in the Orion Nebula," by D. K. Walter and R. J. Dufour, in *The Astrophysical Journal (Letters)*, **434**, L29-L32.

"Ultraviolet Spectroscopy," by R. J. Dufour, in *The Analysis of Emission Lines*, Space Telescope Science Institute Symposium Series, No. 8, eds: R. E. Williams and M. Livio, (Cambridge: Cambridge University Press), pp. 107-133.

Copies of these are included as attachements as well.

3. Continuing and Future Research

We end this report on the note that Dufour's collaborations with Tielens and Rubin at NASA-Ames continues at present. We have been awarded observing time on *HST* and *ISO* for continuing studies of the UV-optical-IR spectra of the Orion Nebula and several bright planetary nebulae in 1996-1997. We expect to submit an new NASA-Ames – Rice University Consortium Agreement Proposal in the near future for continuation of our collaborative research into the 1997-1998 period. .